examination system lingers on, and yearly claims its victims.

The University of Wales is to be congratulated in that so far it has recognised no examinational post-graduate work at other universities as fit work for the graduates sent out to represent it in the academic world. If higher degrees than that of B.A., M.A., or B.Sc. are required by these, there are the degrees of D.Litt., and D.Sc. of their own university, which it is to be hoped will be given solely as a reward for meritorious research.

It is essential for success in research that the man should be started when his mind is fresh, and he has not had time to acquire that morbidly critical habit of mind which residence at some of the universities seems to encourage so much, and which has been so fatal to the performance of real work by many highly gifted men.

Research will encourage resource, and the application of knowledge to real problems will foster a dependence on self which cannot but be of the greatest value to the possessor. Going out into the world of learning in a self-respecting way, received with due recognition of the position he has attained by the university to which he goes to reside, he will gain experience of the world, and be less apt to show that limitation of mental horizon, and that superciliousness of intellect, so characteristic of many, though happily by no means of all, who have taken high honours at the old universities.

But the best answer to the contention that a long and arduous preparation beyond the Bachelor's degree is necessary for successful research is to be found in the fact that already the contrary has been demonstrated at the Welsh colleges. One young man of great promise did most excellent work in Germany in the difficult field of the study of old Celtic manuscripts, another has made his name known in physical research. Both have returned to their college to teach, and their presence has proved a stimulus and inspiration to others. If the example thus set is followed by others in the Welsh University, and the Fellowship system is allowed a patient and fair trial, the results cannot fail to be of the greatest benefit to all concerned. Knowledge will be increased, the University by respecting itself and its students will be respected and its work will be recognised, and its *alumni* will have no cause to complain of the estimation in which the public hold the credentials they have received from their *Alma Mater*.

A. GRAY.

NOTES.

THE meetings of the International Conference on Scientific Literature, held last week at the Royal Society, came to an end on Thursday. A list of the delegates appointed to attend the Conference appeared in last week's NATURE, with an account of the dinner given by the Royal Society in their honour. We hope shortly to give a report of the questions discussed and the resolutions adopted.

THE annual general meeting of the London Mathematical Society will be held on Thursday, November 10. Lord Kelvin has acceded to the request of the Council, and will be nominated for the office of President. Prof. H. Lamb, F.R.S., will be nominated for a Vice-Presidentship. The retiring members are Messrs. Jenkins and G. B. Mathews, F.R.S. The former thus severs his long connection of more than thirty years—he being almost an original member. Prof. Elliott, F.R S., has chosen for the subject of his address, "Some secondary needs and opportunities of English mathematicians."

WITH the object of comparing systems of electric traction suitable for use in London, the London County Council have consented to permit the London United Tramways Company to re-construct one section of their lines in the neighbourhood of Hammersmith on the overhead trolley system of electric traction, on condition that two other sections are laid down on the underground conduit plan.

IN his opening lecture to the engineering students at Cambridge on Friday last, October 14, Prof. Ewing intimated that the crowded state of their lecture-rooms and laboratories would soon be relieved. A gift of 5000*l*. had just been made for the addition of a new wing to the engineering laboratory in memory of the late Dr. John Hopkinson and of his son, John Gustave Hopkinson, who recently lost their lives in the Alps. Dr. Hopkinson's son was to have begun work at this time as a student of engineering at Cambridge. This splendid and welcome gift was made by Mrs. Hopkinson jointly with her son Bertram and her surviving daughter.

THE Harveian Oration was delivered at the Royal College of Physicians on Tuesday by Sir Dyce Duckworth, who, after urging the claims of the college to the consideration of generous benefactors, pointed out that Harvey had definitely charged them to encourage research. The lecturer is reported by the *Times* to have said that what were greatly needed now in England were research laboratories attached to hospital wards and *post-mortem* theatres, and also a select staff of fully trained investigators available for service throughout the Empire. It was surely humiliating that researches were permitted to be made for the public benefit in various parts of British territory by foreigners, while many of their countrymen and countrywomen, owing to ignorance and mawkish sentimentality, were doing their best to debar the training of such men in England. After alluding to the results of recent pathological research in regard to the preventive treatment of tuberculosis, Sir Dyce Duckworth observed that the Röntgen rays had as yet yielded little new information, and their therapeutic influence was not determined, but, according to Rieder, of Munich, the rays emitted from "hard," vacuum tubes killed bacteria. The influence of glycerine in destroying some of the most noxious microbes which gained access to ordinary vaccine lymph was very noteworthy, and he could not but imagine that this agent might yet be found of more extended usefulness as a bactericide. Expressing his private opinion, though he believed it to be shared by the majority of those he addressed, he did not hesitate to stigmatise the recent Vaccination Act as a piece of panic legislation, a lamentable concession to ignorance, fraught with serious peril to the whole community, and unworthy of the duty and dignity of any British Government. He closed with a brief appreciation of Harvey's chief scientific achievements, and of his great guiding principle, devotion to truth.

MR. W. H. PREECE, C.B., F.R.S., will deliver the inaugural address at the new session of the Institution of Civil Engineers, on Tuesday, November 1. The Council of the Institution have made the following awards out of the trust funds at their disposal for the purpose for original papers dealt with during the year 1897-98. The formal presentation will take place on November 1:—Telford medals and premiums—A. H. Preece (London) and H. C. Stanley (Brisbane, Queensland); Watt medals and premiums—H. L. Callendar, F.R.S. (London), and J. T. Nicolson (Montreal, Canada); George Stephenson medals and premiums—Whately Eliot (Plymouth), W. O. E. Meade-King (London), and W. P. Marshall (Birmingham); the Crampton prize—E. W. Anderson (Erith); Telford premiums—L. B. Atkinson (Cardiff), Henry Fowler (Horwich), W. L. Strange (Bombay), F. J. Waring (London), D. W. Brunton (Denver, U.S.), Wilfred Airy (London), E. M. Bryant (Newcastle-on-Tyne), D. B. Butler (London), and H. V. Champion (Victoria); the James Forrest medal—W. L. Brown (London); Miller prizes—C. E. Wolff (Derby), A. D.

Keigwin (Ashford), Harold Williams (Kingston), J. T. Morris (London), H. C. Adams (Birmingham), H. O. Eurich (Bradford), B. K. Adams (Colombo), A. B. E. Blackburn (Wednesbury), Thomas Carter (Newcastle), P. F. Story (Manchester), D. E. Lloyd-Davies (Bewdley), and Wilfred Hall (Corbridge-on-Tyne).

The Hayden Memorial Award of the Philadelphia Academy of Natural Sciences has been made to Prof. Otto Martin Torell, formerly professor of zoology and geology at the University of Sweden, and late Chief of the Geological Survey of Sweden. Of his works, those which treat of the ice period are the most important. To these belong "Contribution to the molluscan fauna, with a general view of the natural state of the Arctic regions," "Investigations of the Ice Period," and "On the causes of glacial phenomena in the north-eastern portion of North America." Partly by these works and partly by lectures Torell has, in Sweden as abroad, actively assisted in making known the theory that the territory of northern Europe, where great blocks of Scandinavian rocks have been found, was formerly covered by land ice, extending from Scandinavia, like the ice in Greenland at the present time, and not, as had been formerly supposed, by a frozen sea (Eismeer). Dr. Torell is a member of the Royal Society of Sciences of Sweden (1870), of the Agricultural Academy (1872), and of many other scientific societies in Sweden and abroad. He is Commander of the Swedish "North Star," Grand Officer of the Italian Order of the Crown, Knight of the second class of the Russian Order of St. Anna, Commander of the Danish Dannébrog, Officer of Public Instruction, and Officier de la Legion d'honneur.

From the report of the Laboratories Committee, presented at the quarterly meeting of the Council of the Royal College of Surgeons of England, held on Tuesday, it appears that since June 3 last 7050 doses of antitoxin, each containing 2000 units, and 2325 doses, each containing 4000 units, for the treatment of diphtheria in the hospitals of the Metropolitan Asylums Board, have been supplied, and all demands fully met. In deference to the researches in connection with the grant from the Goldsmiths' Company, Dr. T. G. Brodie and Dr. Cartwright Wood have continued their investigations and have planned out a further series of experiments for the coming winter. The Committee has awarded to each of them a further sum of 50*l.* from the research grant, as a recognition of their valuable work. Dr. T. G. Brodie is at present engaged on the chemistry of diphtheria antitoxin, and Dr. Cartwright on diphtheria toxins and antitoxins, and a method of examining water bacteriologically. The demand for antitoxin supplied to general and children's hospitals in London, in accordance with the conditions of the grant from the Goldsmiths' Company for use among the poorer classes of the community, is steadily increasing.

The death is announced of Prof. Andreas Arzruni, professor of mineralogy and petrography in the Technical High School at Aachen, and of Dr. C. G. Gibeli, professor of botany and director of the Botanical Institute at Turin.

A meeting of the Physical Society will be held on Friday, October 28. The papers down for reading are: An influence machine, by Mr. W. R. Pidgeon; the repetition of an experiment on the magneto-optic phenomenon discovered by Righi, by Prof. Silvanus P. Thompson, F.R.S.; the magnetic fluxes in meters and other electrical instruments, by Mr. Albert Campbell.

The following meetings of the Royal Photographic Society are announced:—Technical meeting, Tuesday, October 25, "On the alleged discovery of photography in 1727," by R. B. Litchfield; "On the grain of photographic negatives," by E. Duncan Stoney. On Monday, October 31, slides will be shown by members of affiliated societies at the exhibition of the Royal Photographic Society.

The *Athenæum* states that the Vienna Academy of Sciences has chartered the Swedish steamship *Gottfried* for its projected scientific expedition to South Arabia. The ship is expected to arrive in a few days at Trieste, where the members of the expedition will go on board. The leader of the party is Count Carl Landberg, the Bavarian Orientalist, who has already spent several winters in the district. Dr. H. Müller proposes to devote his researches to the Sabæan inscriptions and the pre-Arabic archæology. Prof. Simony will accompany the expedition as botanist, Dr. Cossmat as geologist, and Mr. Bury will be the leader of the caravan. Dr. Jahn will take as his speciality the study of the Mahra language. Dr. Layn goes as physician to the expedition.

We learn from *Science* that, through the generosity of Mr. Cornelius Vanderbilt, the New York Botanical Garden is about to undertake a botanical exploration of the island of Porto Rico. The expedition, which is now being organised, will leave for the new Colony within a few weeks, and will be occupied in collecting museum and herbarium specimens and living plants for at least six months. Inasmuch as very little is yet known concerning the natural flora of the island, it is confidently expected that much of value and interest will be secured, and the collections will furnish the basis of a report on the botany and vegetable productions of our newly-acquired territory.—During the past summer much progress has been made in the New York Botanical Garden, in Bronx Park. The construction of the museum building has proceeded rapidly, three-fourths of its steel frame being in place, the walls being completed as far as the second story. The warm and wet summer has been favourable to the plants. Much progress has been made in planting the border, which will be completed during the autumn. It will be about two miles in length, and will contain some three hundred and fifty varieties of trees and shrubs.

An instructive and interesting account of the cultivation of plants yielding Parà rubber, the collection and preparation of the rubber, and other aspects of the industry, is given in the *Kew Bulletin* for October. With regard to future prospects of the rubber from the vast region drained by the Amazon, Mr. Consul W. A. Churchill is quoted to have remarked as follows, in a recent report to the Foreign Office:—"Some people suppose that the supply of Amazonian rubber may become exhausted in the near future. The most competent authorities are not at all of this opinion, but maintain that the supply is inexhaustible, because the *Hevea* is continually being reproduced by nature. Certainly some areas become exhausted when overworked, but when left alone for some time they recover. . . . The area that is known to produce Parà rubber amounts to at least 1,000,000 square miles. Further exploration will, no doubt, show that this area is under-estimated." The introduction of the rubber-yielding trees of tropical America to British Possessions in the East was an enterprise in which, more than twenty years ago, Kew took an active part, the expense being borne by the Government of India. A survey of the results of experiments carried out in various places in which the cultivation of rubber has been attempted, is given in the present number of the *Bulletin*.

In a recent paper on "The accepted altitude of the Aurora Borealis," read by Prof. Cleveland Abbe before the American Philosophical Society, he stated that some observers have seen the light in such positions between themselves and neighbouring objects as to demonstrate that the aurora, like the lightning, may be entirely confined to the lowest stratum. Others have seen it so located among the clouds that its origin must be placed at or below their level, and, therefore, within a few thousand feet of the earth's surface. On the other hand, those who have calculated the altitudes of specific beams by trigonometrical or equivalent methods have deduced heights of twenty to a hundred miles; Dr. Boller has even quoted an altitude of 1243 miles. Prof. Abbe remarks that, after reviewing the literature of the subject since the time of Halley, he finds that all methods agree in one fundamental assumption that the observed beams and arches have an individual existence and a definite *locus*. But this assumption is negatived by the equal frequency of negative and positive parallaxes wherever the parallax method is applied. The only conclusion possible is that the observers do not see the same object, partly because the aurora is too low down, and partly because there are optical illusions due to alignment.

DURING the present year, Dr. Doberck, Director of the Hong Kong Observatory, published a useful pamphlet on "The law of storms in the Eastern seas," the first part of which was issued in 1886. The work is illustrated by plates showing the different classes of typhoons, and their average tracks and rate of progress, based upon 244 storms registered during the past thirteen years. A translation of the pamphlet by Dr. P. Bergholz, of Bremen, appeared in the *Meteorologische Zeitschrift* for September, thus testifying to the value of Dr. Doberck's investigations to the sea-faring community, and to maritime meteorology generally.

THE special Antarctic number of the *Scottish Geographical Magazine* ought to be widely distributed and read, in order to excite a little more practical sympathy with scientific Antarctic exploration than has yet been shown by the general public. Sir John Murray pleads strongly for a British Antarctic Expedition. At the present moment, he points out, scientific men in Germany are making arrangements, with the approval and support of their Government, for the exploration of the Antarctic in the year 1900. We have been asked to co-operate, at the same time, in this exploration, but our Government has expressed itself unable to support the undertaking, and there is little hope of the necessary funds being procured from private sources. The outlook is thus not at all promising so far as British science is concerned; and unless the unexpected happens, we shall have to stand aside while other countries carry through the great work of examining the south polar area, and reap the results of their enterprise. Sir John Murray suggests that a rich man, or several rich men, should place in the hands of the President of the Royal Society at least 100,000*l.* for the purpose of organising an Antarctic expedition to co-operate with the other expeditions that are preparing to set out in the year 1900. Here is a splendid opportunity for wealth to assist most usefully in the development of knowledge, and earn renown for British science. May the desire to place our country in the fore-front in scientific research, and especially in oceanic explorations, move some generous benefactor to provide means for equipping and sustaining an expedition which will be a credit to the nation and to science. The whole history of Antarctic exploration, including complete reports of the discussion of the subject at the Royal Society on February 24 (see NATURE, vol. lvii. pp. 420-427), and an excellent map of the south polar regions, is given in the *Scottish Geographical Magazine*, and we trust its publication will produce a practical result.

The August number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* (Paris) is occupied almost entirely by an article by M. L. de Chasseloup-Laubat, on the steamboat service of this country, the United States, Germany and France. The development of steam navigation is traced, and full descriptions given of all the principal steamers which have been engaged in the passenger service of the world, and of some cargo boats. The article contains detailed particulars of the dimensions of the boats, mode of construction, engines and fittings, speed and draught. In some of the more modern boats, such as the *Campania*, particulars are given of the staff and crew engaged in working the boats, and the quantity of coal and provisions used. From the tables given it appears that for the number of cabin passengers carried the American Line stands first, followed in order by the Cunard, White Star, Hamburg-American and Norddeutscher Lloyd. The German boats carry the greatest number of emigrants. The article is very fully illustrated, and contains several tables as to the time occupied in the different voyages, details of dimensions, horse-power and other matters.

A MAGNIFICENT meteor was observed at numerous points in Ontario, at 8.50 standard time of July 5, and many descriptions of it appeared in the newspapers at the time. Mr. F.F. Payne gives a few particulars of the meteor in the July number of the Canadian *Monthly Weather Review*, which has just reached this country. The meteor was described by observers as a ball of lurid light, apparently about ten inches in diameter, exploding with a loud rumbling noise like thunder, and leaving a long sinuous trail of white vapour, which was visible for at least six minutes afterwards. As is usual there was some apparent disagreement between observers as to the meteor's flight, the popular opinion prevailing that its course must be parallel to the earth's surface, its vertical motion scarcely being considered. From data received, Mr. Payne thinks that the meteor became visible at a height of 125 miles above the earth's surface at a point somewhat to the eastward of Collingwood, over which place it passed near the zenith, its path being inclined a little to the north of west. It apparently exploded over the Georgian Bay in latitude 44° 50′, longitude 80° 30′, and the observer at Collingwood states that "a loud rumbling noise was heard."

THE question of the determination of the neutral elements of involutions presents considerable difficulties to the mathematician. An important contribution to the solution of this problem is given by M. F. Deruyts, of the University of Liége, in the *Bulletin* of the Belgian Academy. The same mathematician also considers certain properties of gauche curves, his conclusions including amongst others the following interesting result:—"Through $9 - k$ points of space there can be drawn

$$2(k - p + 1)\binom{2n - k + 1}{p}\binom{2n - k}{p - 2},$$

gauche curves of the fourth order having contact of order $(k - p + 1)$ with a given gauche curve of order n, and meeting this curve in $2p - 3$ points."

THE installation of a storage battery of ten thousand cells has enabled Prof. John Trowbridge to undertake an inquiry into the nature of electrical discharges in air and gases under conditions which render the investigation practically an incursion into a new region of research. The results of his investigations have on several occasions been referred to in these columns; nevertheless the following *résumé* of certain conclusions, from his paper in the *Proceedings* of the American Academy of Arts and Sciences, vol. xxxiii. No. 21, is of interest:—Beyond 1,000,000 volts the initial resistance of atmospheric air to electric discharge decreases, and may become as low as 1000 ohms between terminals 2 or 3 inches apart. When the initial resistance of highly rarefied air is broken down by x-rays, it exhibits less resistance than it does at 2 mm. pressure when its conductivity is generally considered to be greatest. There are anode as well as kathode x-rays, and these rays exhibit all the peculiarities of the kathode rays. The x-rays can be distinctly produced with an electromotive force of 10,000 volts, and there are indications of them at 5000 volts. Electrostatic induction is an important phenomenon in that of *x*-rays; experiments indicate that these rays are evidence of an electromagnetic disturbance, which therefore travels with the velocity of light, and is accompanied by molecular excitation. The mechanism of the production of *x*-rays appears to be a setting-up of electrostatic lines of induction, and a production of an electromagnetic wave or impulse; the stress in the medium reduces its resistance, and the *x*-radiations become less and less energetic after a certain interval the longer the Crookes' tube is excited. The behaviour of rarefied media to powerful electric stress is analogous to that of elastic solids to mechanical stresses; a so-called vacuum, which acts as an insulator for electromotive forces giving a spark of 8 inches in air (about 200,000 volts), breaks down under 3,000,000 volts. A single discharge with this voltage through highly rarefied media produces *x*-rays powerful enough to give a photograph of the bones of the hand in one-millionth of a second. During the discharge the apparent resistance of the medium is only a few ohms. In this case the medium seems completely to lose its elasticity, so to speak, and is ruptured, and the elastic solid analogy thus seems to elucidate the question of the electrical conductivity of the ether.

MR. D. E. HUTCHINS, Conservator of Forests at the Cape, recently read before the Cape Town Philosophical Society a paper showing the need and value of extending the area in the Colony at present under forest. Cape Colony stands far below other countries in its proportion of forest, though the climate of the country is such that it ought to have a percentage under forest at least equal to Germany. The following table shows the area under forest in the Colony compared with that in some other countries:—

Countries.	Area under forest in acres.	Percentage under forest of total area of country.
Russia in Europe	527,427,000	42
Sweden	42,366,000	42
Austria	46,856,000	31
Germany	34,350,000	26
Norway	18,920,000	25
India	140,000,000	25
France	20,750,000	16
Portugal	1,666,000	5
Great Britain and Ireland	2,790,000	4
Cape Colony	353,280	0·29

Mr. Hutchins suggests that plantations should be formed in districts within minimum rainfall limits of 15 or 20 inches per annum. The argument which will perhaps appeal most forcibly to Cape agriculturists is that while the total value of the fruit produced in Cape Colony is 100,000*l*., no less than 269,349*l*. have been paid for wood imported into the Colony during the last two years, nearly the whole of which would be produced in national forests covering an area of about 50,000 acres. That forests can thrive where agriculture is difficult or impossible, is shown by the steep richly-wooded slopes of the lofty Amatolas, the similarly beautiful forest with its gigantic yellow-wood trees in the barren Knysna country, and, perhaps most striking of all, the cedar trees of Clanwilliam, growing on the absolutely bare rocks of the stupendous Cedarberg Range; while at Genadendal an introduced tree, the cluster pine, hardier than any of the indigenous trees, is spreading itself self-sown up the rocky mountain-side, in spite of fires, drought, hot winds and climatic vicissitudes, that are too often the despair of the agriculturist.

A PAPER on the "Wanton Mutilation of Animals," contributed by Dr. George Fleming to the *Nineteenth Century* for March 1895, has been issued in separate form by the Royal Society for the Prevention of Cruelty to Animals. The paper shows that many mutilations of this kind can boast of a venerable antiquity, and are practised in many countries. The practice of removing a portion of the tails of certain breeds of dogs appears to have been instituted as a means for the prevention of rabies, the belief being that the sinew which followed the piece bitten off was a worm which produced madness. "Worming," which was performed upon dogs for the same purpose, consisted in the excision of the frænum of the dog's tongue, under the impression that it had something to do with madness. Ear-cropping of dogs has been carried on for two or three centuries. Horses are subjected to tail-docking, ear-cropping, nostril-slitting, and other unnecessary mutilations. The fashion of mutilating horses appears to have prevailed at a very early date in England, and may have been introduced from Germany or Scandinavia. Dr. Fleming's descriptions will assist in suppressing these cruel and useless practices.

MESSRS. WILLIAMS AND NORGATE'S Book Circular for October, and their latest list of second-hand books (No. 10), contain the titles of a number of volumes on scientific subjects.—A more elaborate catalogue, occupying 686 pp., is the new volume of "Naturae Novitates" just issued by Messrs. R. Friedländer and Son, Berlin. This publication not only contains classified lists of books in many languages on all branches of science, but the works named in it are indexed according to subjects and authors.

THE following official publications from our foreign possessions have reached us:—*The Central Africa British Gazette* (published at Zomba) for July 9, containing an interesting report on the cultivation of coffee, compiled by the Commissioner of Agriculture to the Hawaian Government; Report on the Botanic Gardens and Domains, New South Wales, for the year 1897, by the Director, Mr. J. H. Maiden; Annual Report of the Royal Botanic Garden, Calcutta, for the year 1897–98, by the Superintendent, Dr. D. Prain, chiefly occupied by a list of exchanges; *Bulletin* (No. 15) of Miscellaneous Information from the Royal Botanic Gardens, Trinidad, edited by the Superintendent, Mr. J. H. Hart, and consisting of a conspectus of the genera of Ferns and Fern-allies of the Colony, and a monograph of the Cyatheaceæ, comprising the genera *Alsophila* (14 sp.), *Hemitelia* (15 sp.), and *Cyathea* (25 sp.); *Circular*, Nos. 4–7, of the Royal Botanic Gardens, Ceylon, issued by the Director, Mr. J. C. Willis, in which the extension of the rubber cultivation in the island is advocated, especially that of the Parà rubber, *Hevea brasiliensis*, which is stated to be well suited to the climate of the low country in the south-west of Ceylon.

THE additions to the Zoological Society's Gardens during the past week include a Tantalus Monkey (*Cercopithecus tantalus*, ♂) from Lagos, presented by Mr. Arthur T. Warren; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. H. W. Mote; two American Flying Squirrels (*Sciuropterus volucella*) from North America, presented by Mrs. Nias; a Bengalese Cat (*Felis bengalensis*) from the East Indies, presented by Mr. David J. Munro; a Ruddy Ichneumon (*Herpestes smithi*) from India, presented by Mr. J. Lyons; a Black-headed Lemur (*Lemur brunneus*) from Madagascar, deposited; an Eland (*Orias canna*, ♂), bred in France purchased.

OUR ASTRONOMICAL COLUMN.

THE ANDROMEDA NEBULA.—In this column (September 22, p. 515) we have previously referred to the telegram which informed us that M. Seraphimoff had discovered, near the centre of the nebula of Andromeda, a stellar-like condensation. Writing to the *Astr. Nachr.* (No. 3523), he states that the central condensation is no nebulous nucleus, but is quite a distinct star of magnitude 10–11. Measurements with a star of magnitude 11 in the neighbourhood showed that the observed